Forest fires and climate change: Present and future evolution in Galicia (NW Spain)

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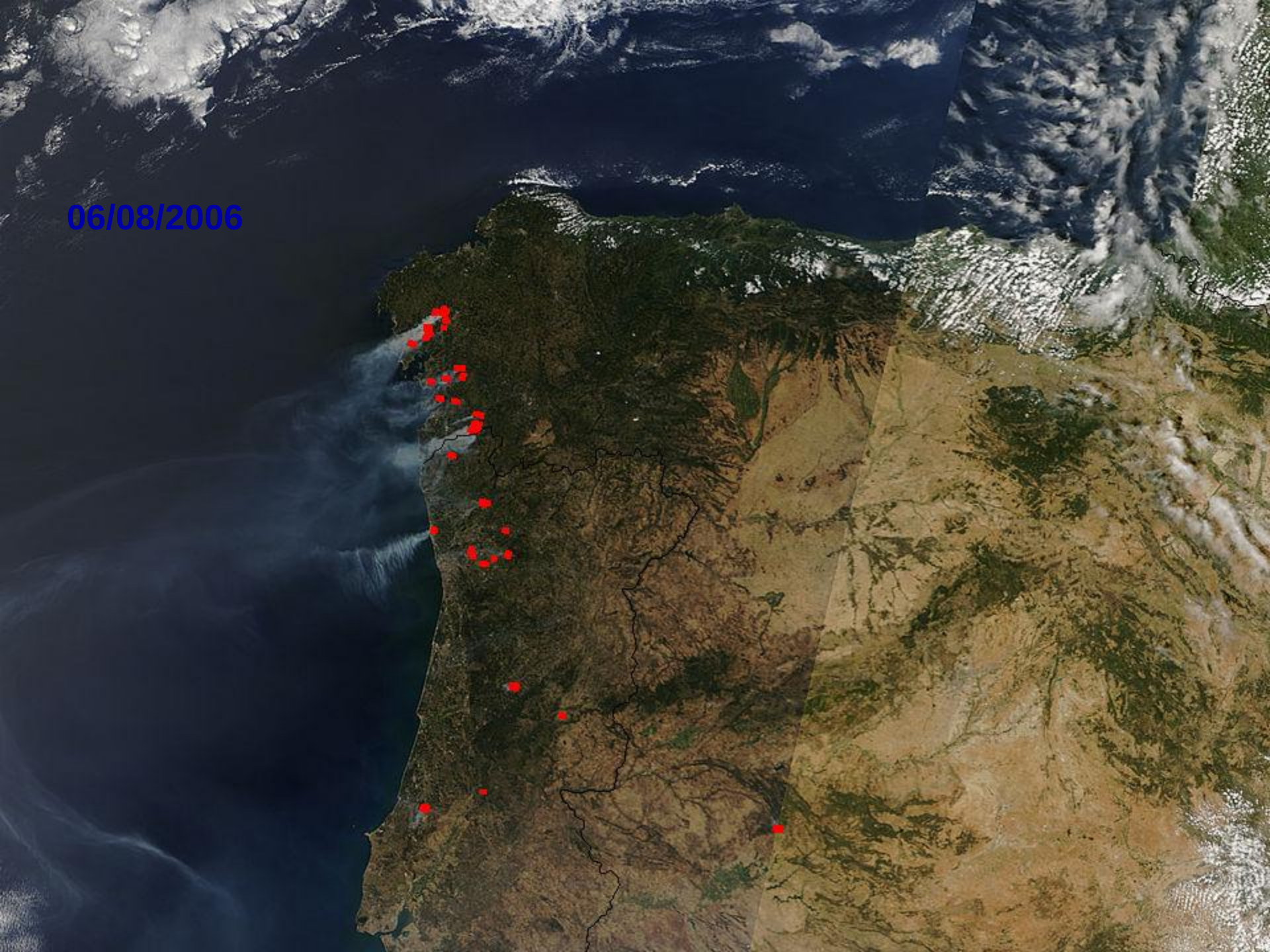
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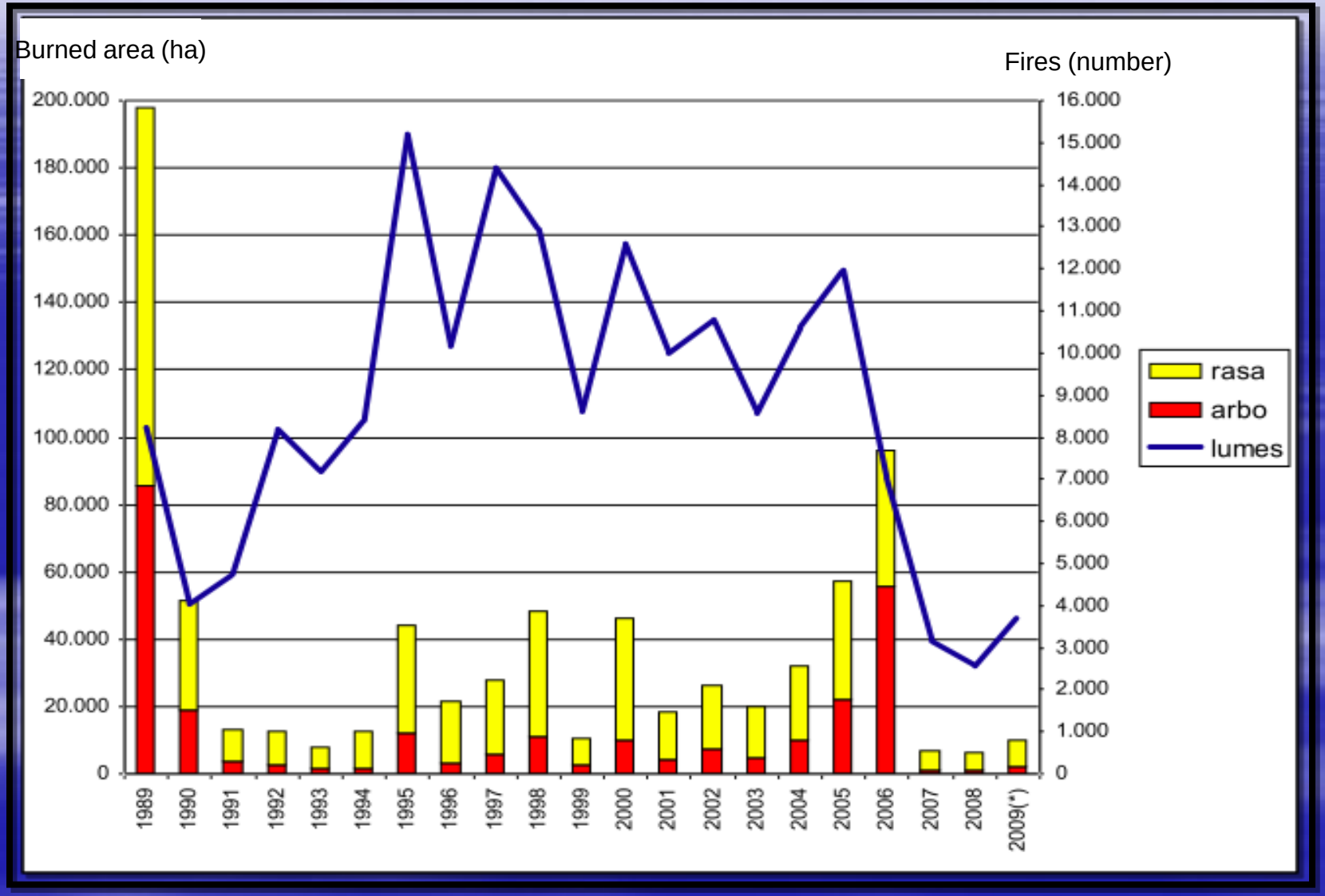
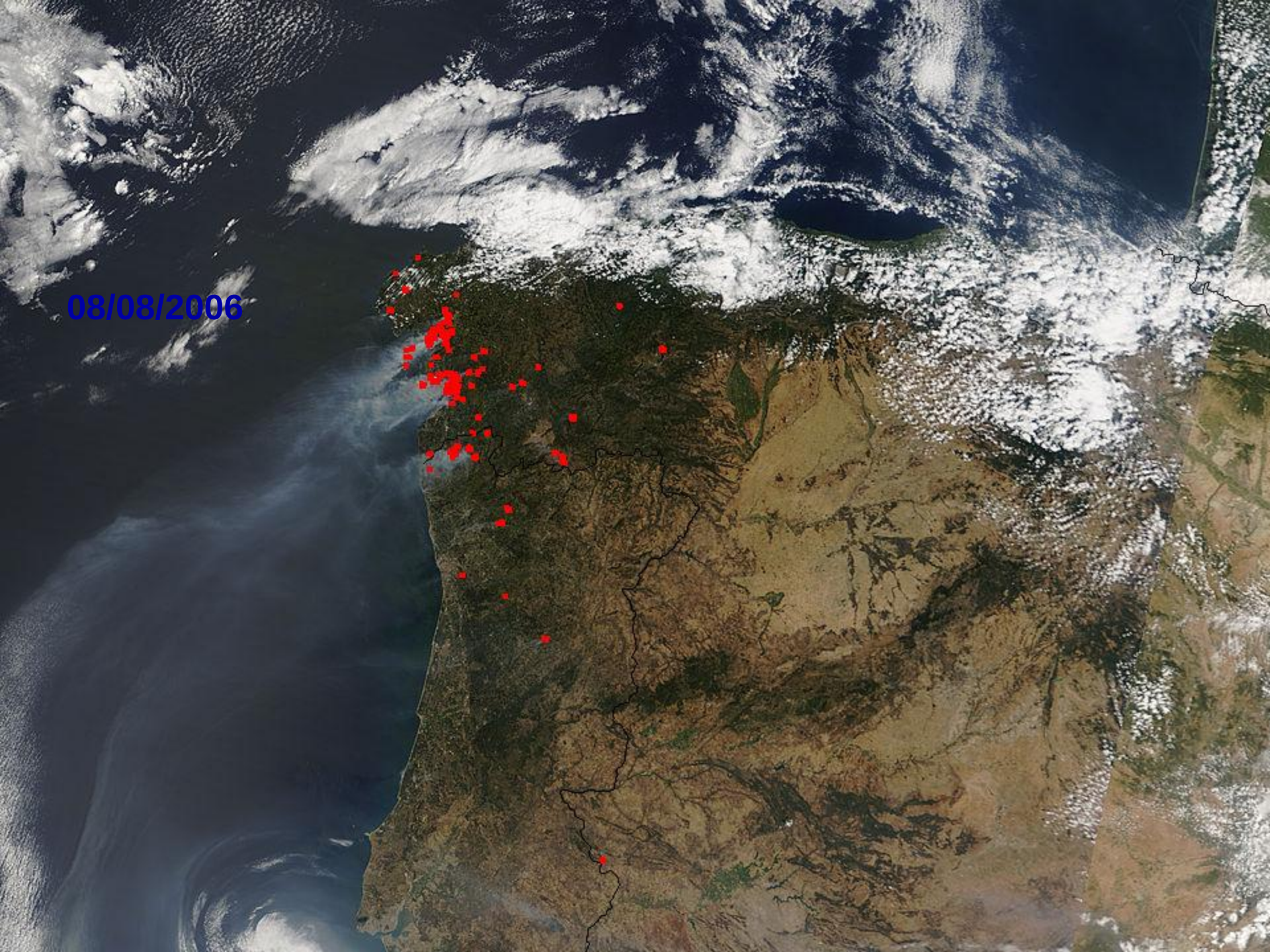
Forest Fires in Galicia

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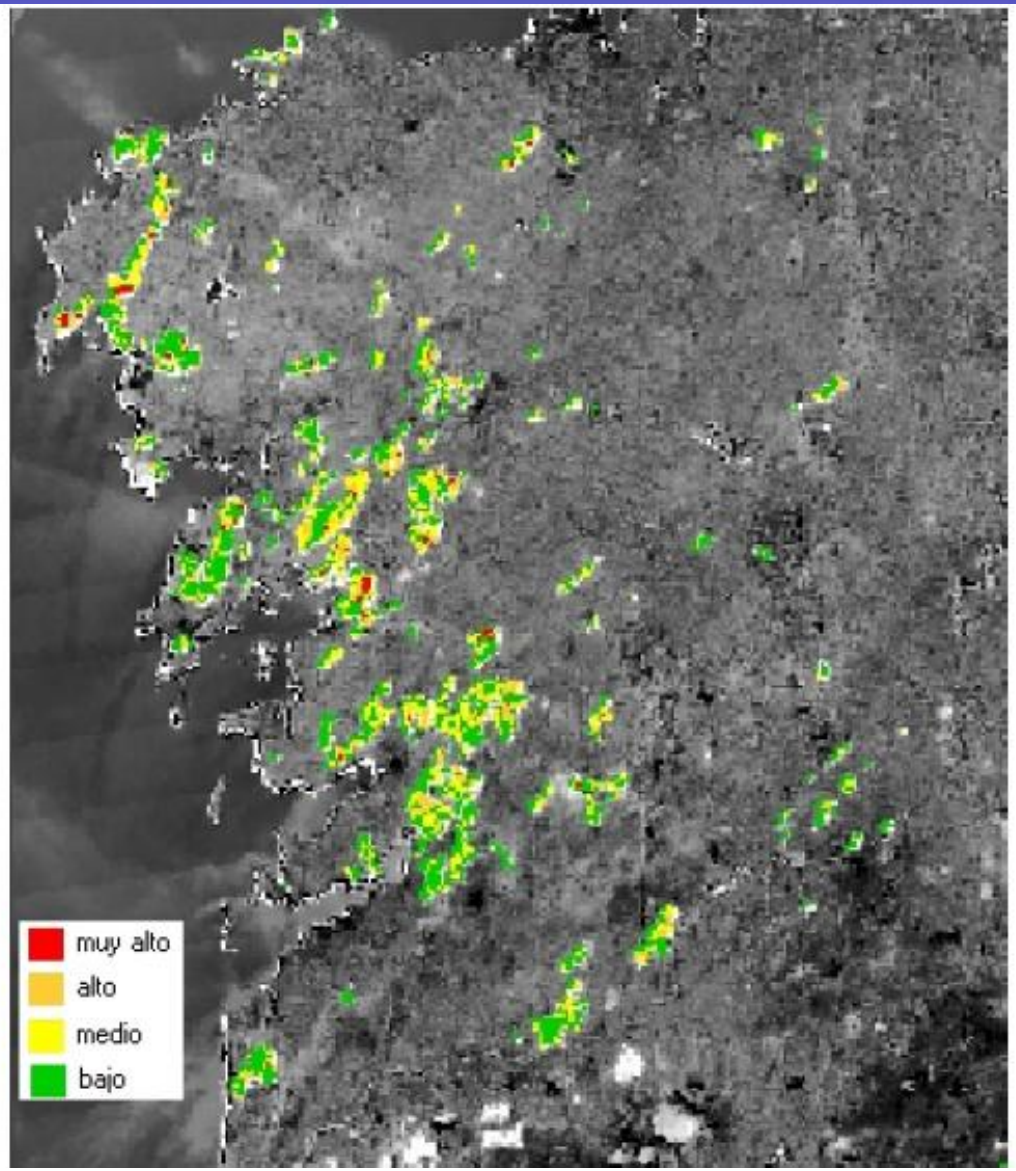


NBR AND BAI COMBINED

36% low severity

55 % medium-high severity

9% high severity

Estimated economic losses derivated from 2006 summer forest fires

Similar to those derivated from the "Prestige"

1.9 % Galician GNP

* Direct losses ≅ 851.10^6 €

* Medium term effects ≅ 1800.10^6 €:

- Agriculture 245.10^6 €
- Tourism-90.10^6 €

Fire fighting sytems costs grew to 120.10^6 €

Climate change may increase forest fires and the emissions of greenhouse gases

Greenhouse gases emissions

-Air temperature increase
-Precipitation decrease
-Evapotranspiration increase

Forest Fires

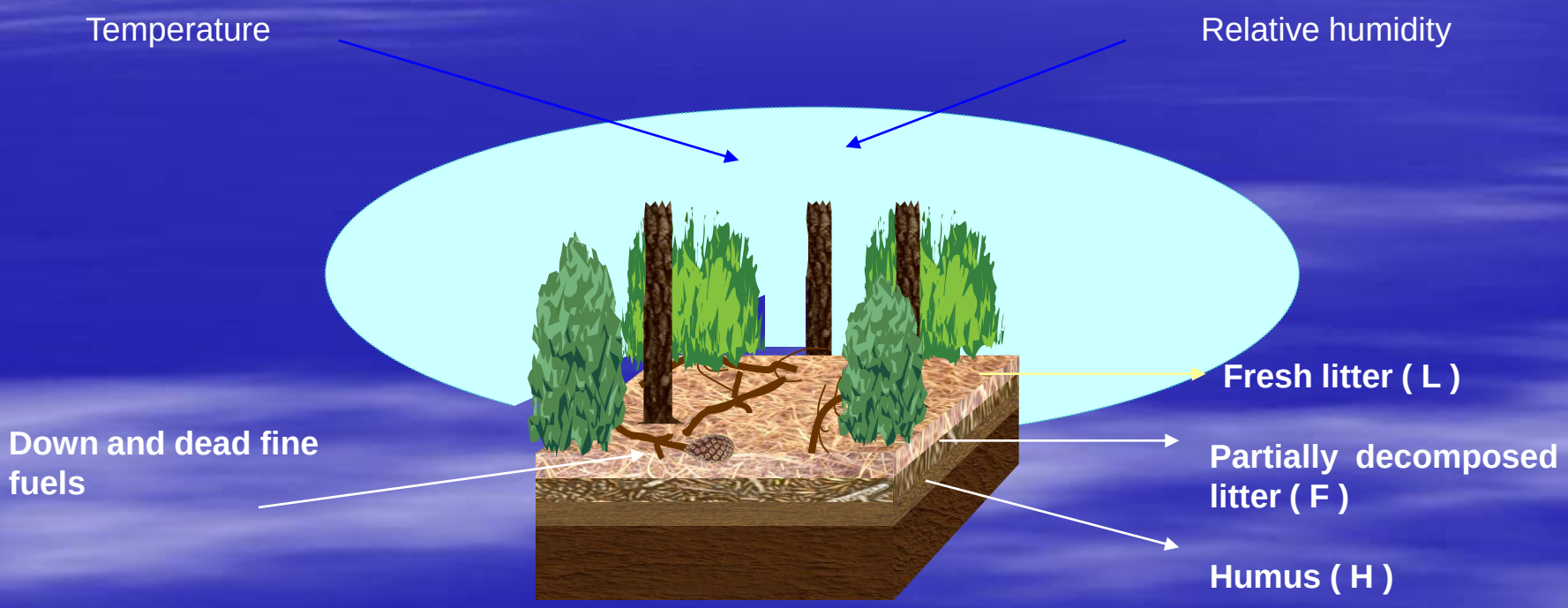
Increase of fuels flammability and fuel loads

-Increases CO_2, N oxides , CH_4…
-Particulated materials

- Forest fires danger indices summarize different information relative to fire risk in an area.
- Forest fire danger indices are based on meteorological information that influence fire initiation and propagation.

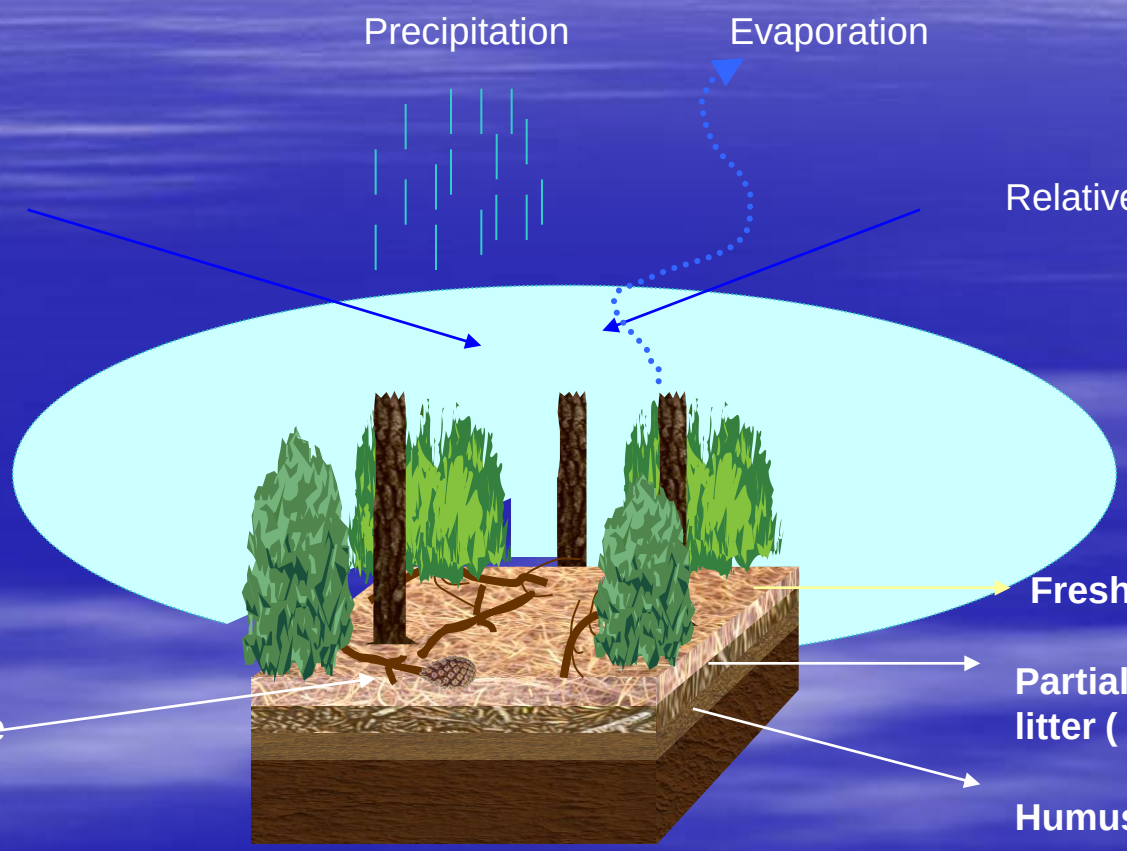
We have explored the sensibility of two types of indices:

Dead and downed fine fuels moisture estimators. Their inputs are air relative humidity and temperature.

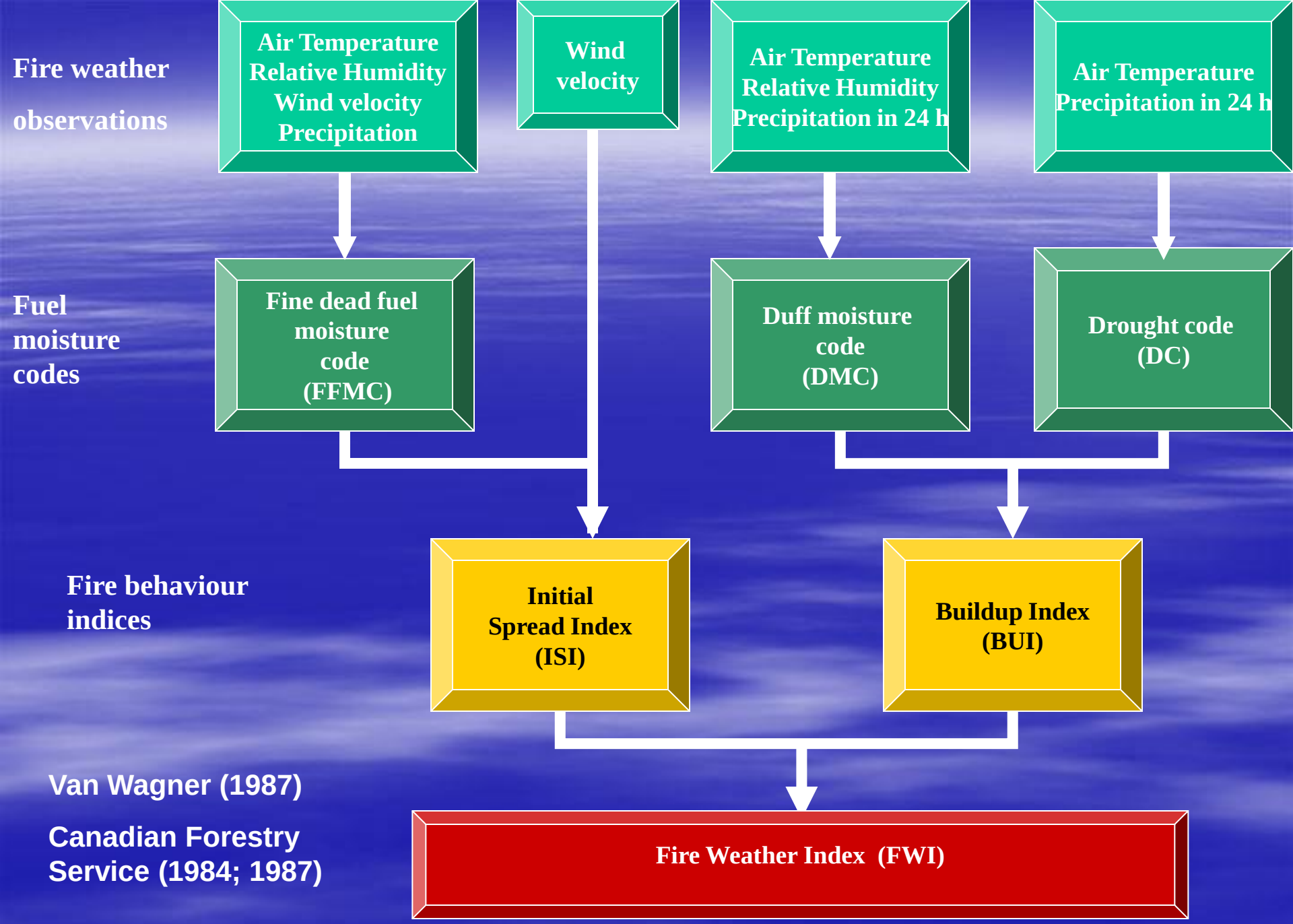


CBEF, FBO, GDM, FFDM

The second group of idices also take into account the precipitation and evaporation



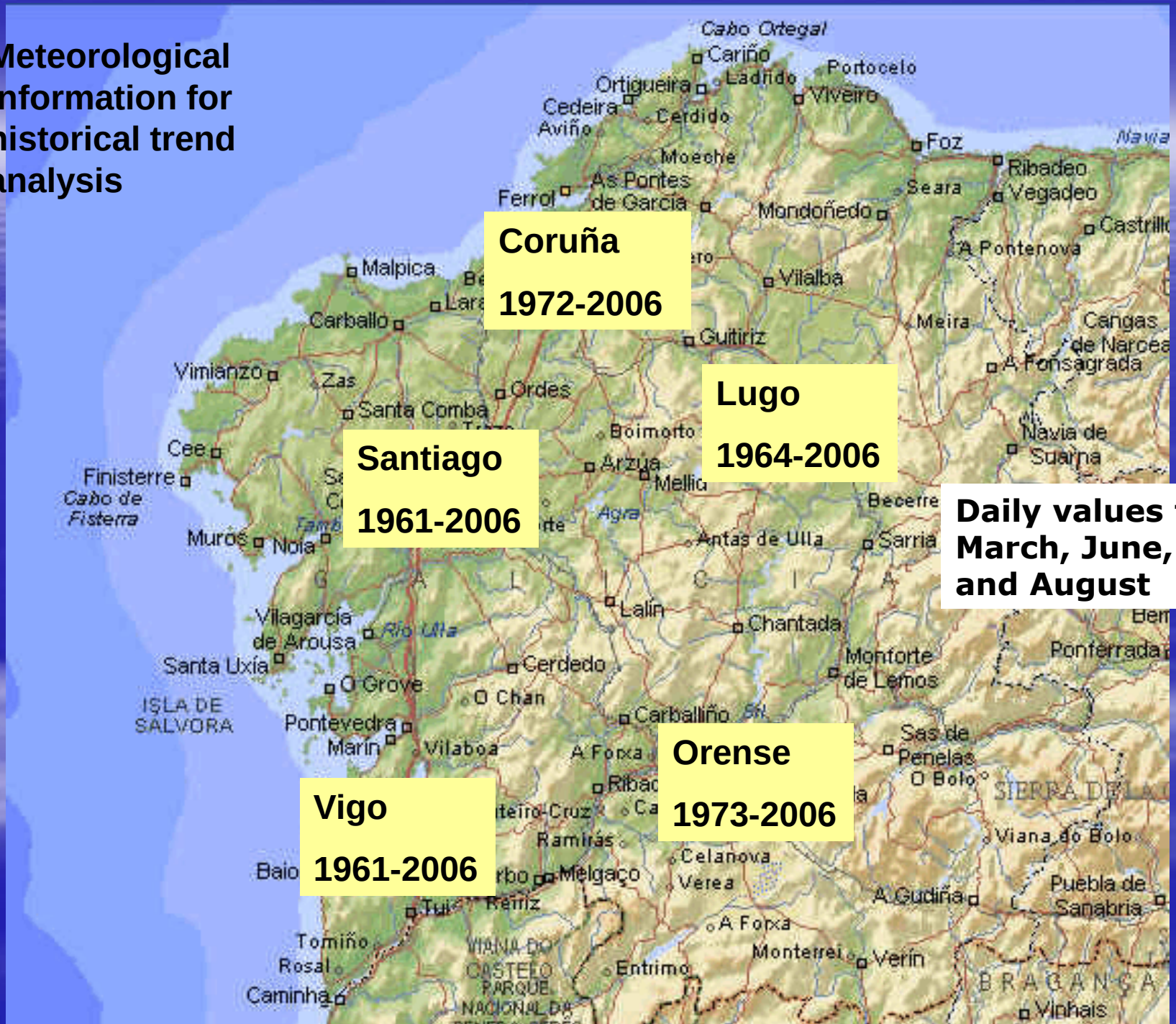
BEHAVE, Canadian Forest Fire Danger Rating System components



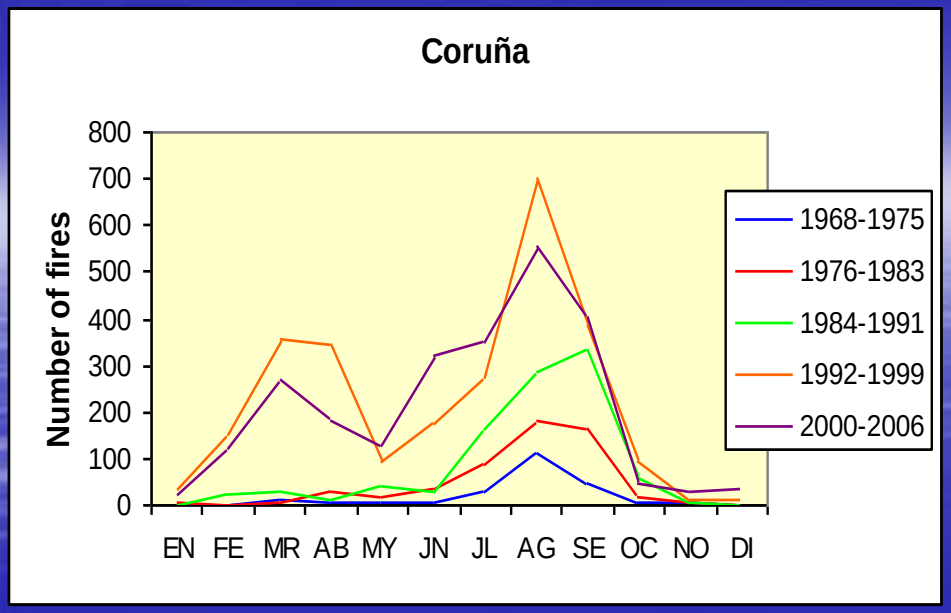
Van Wagner (1987)

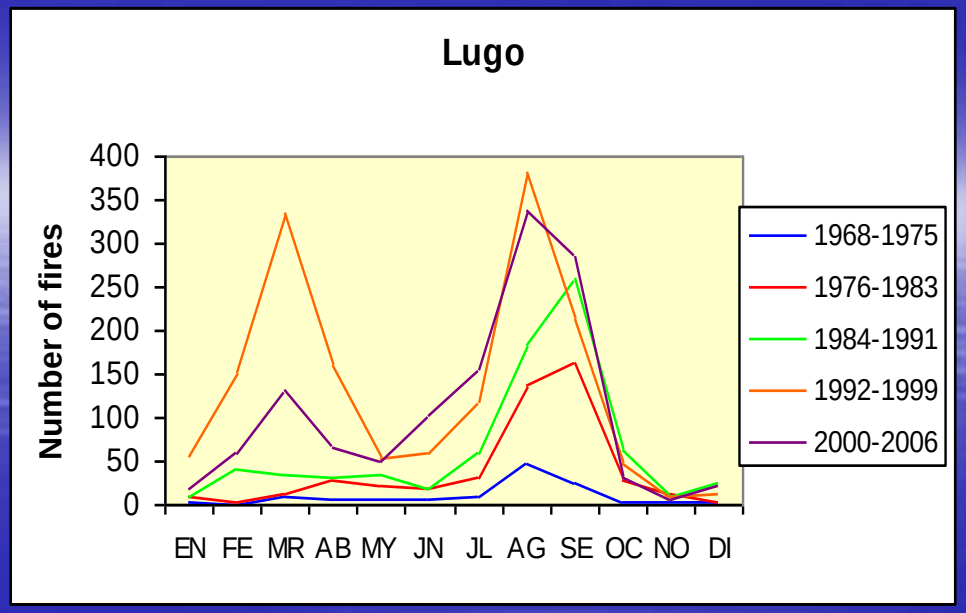
Canadian Forestry Service (1984; 1987)

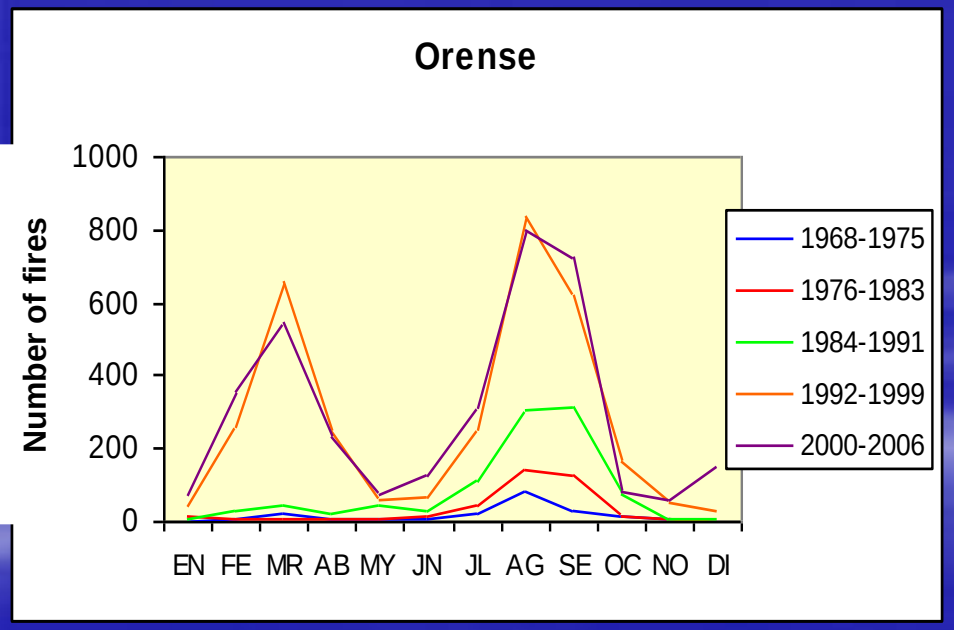
Meteorological information for historical trend analysis

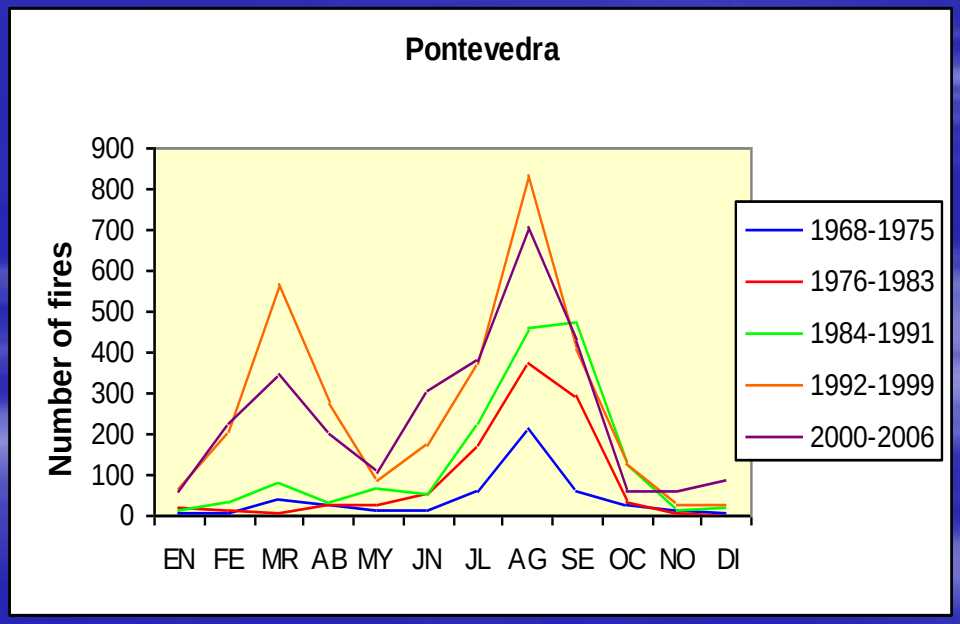


Daily values for March, June, July and August







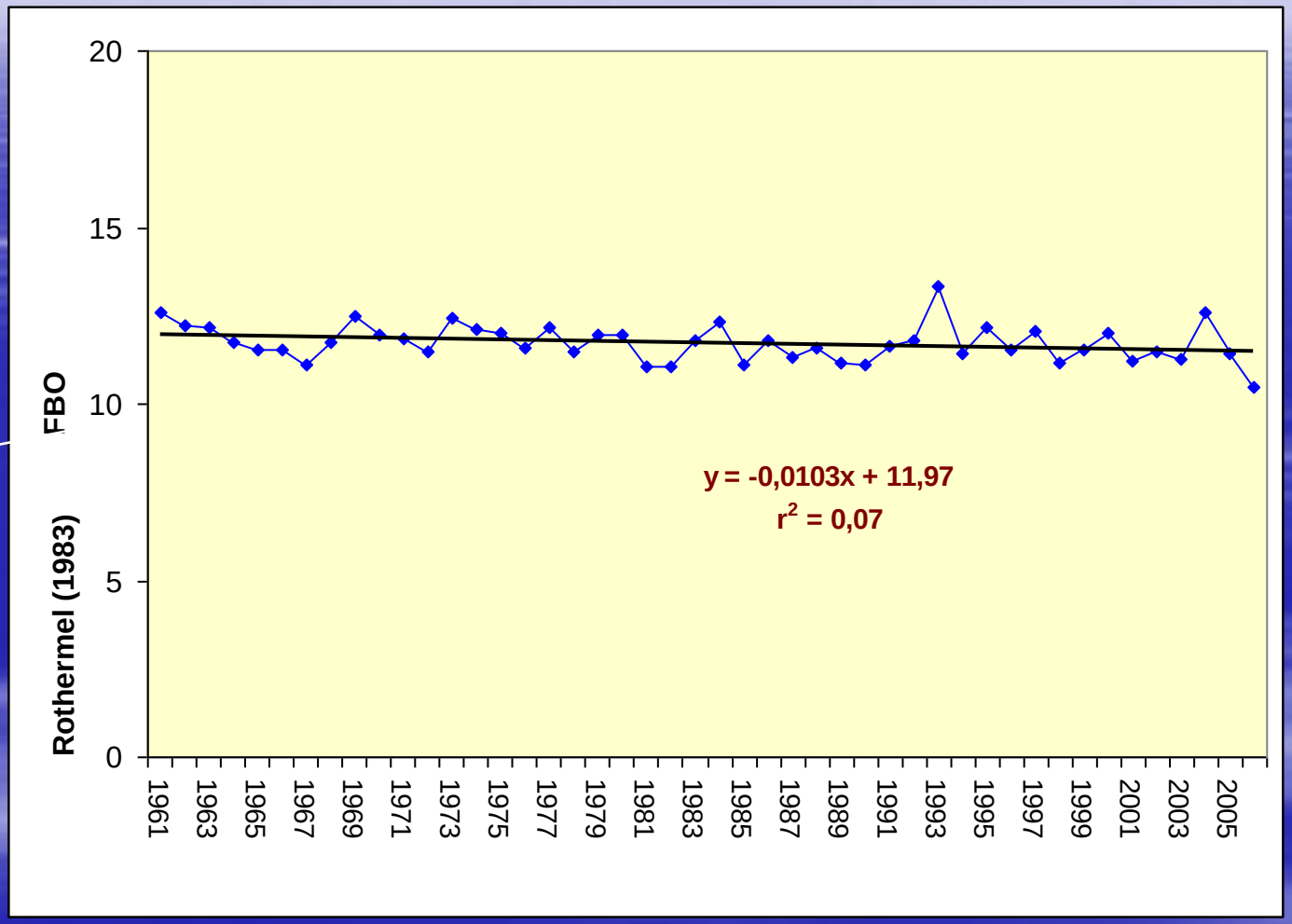


Forest fire season has been anticipated and the bimodal distribution of fires is accelerated in the last decades.

HISTORICAL TRENDS

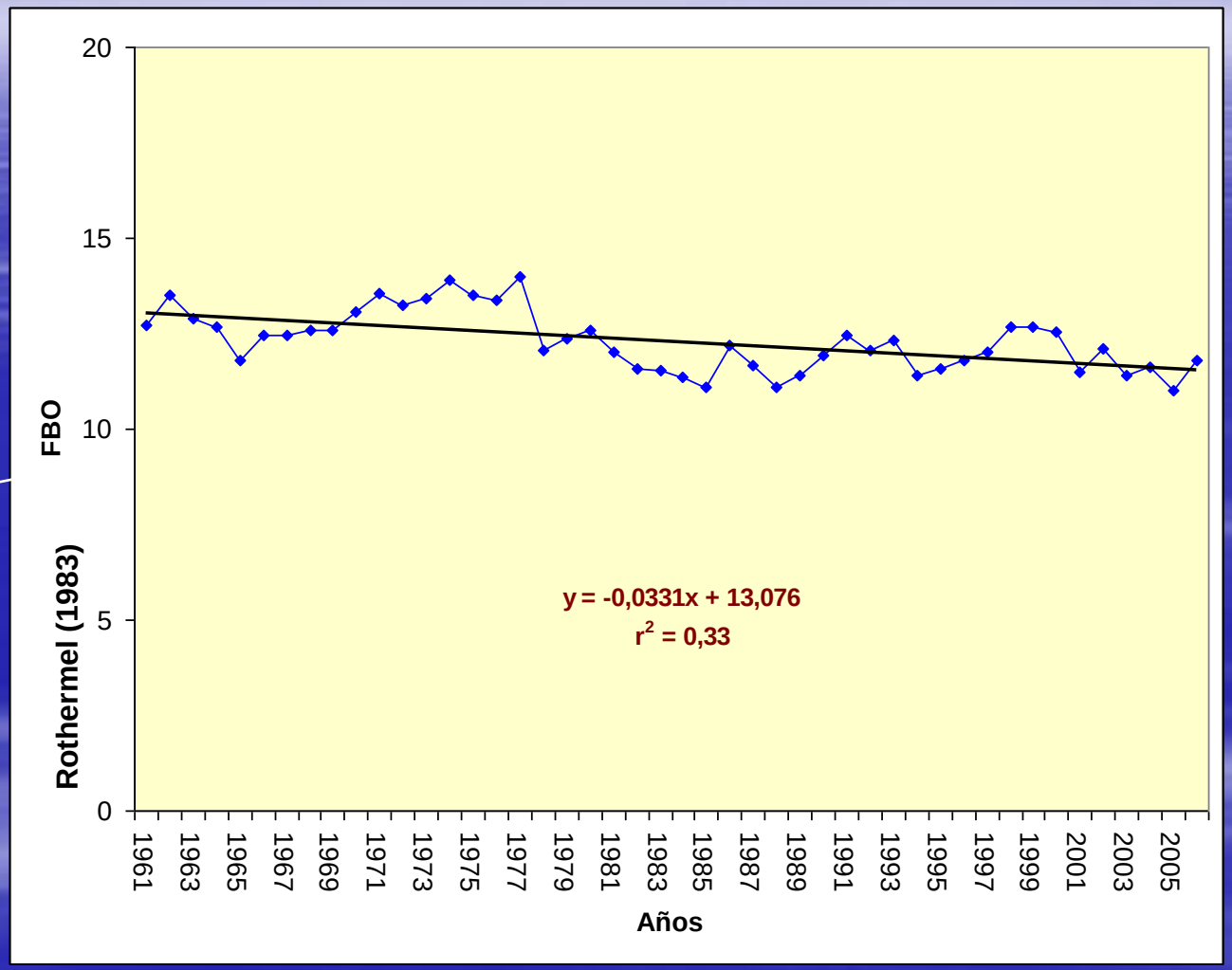
SANTIAGO-SEPTEMBER

Dead fine fuel moisture estimator



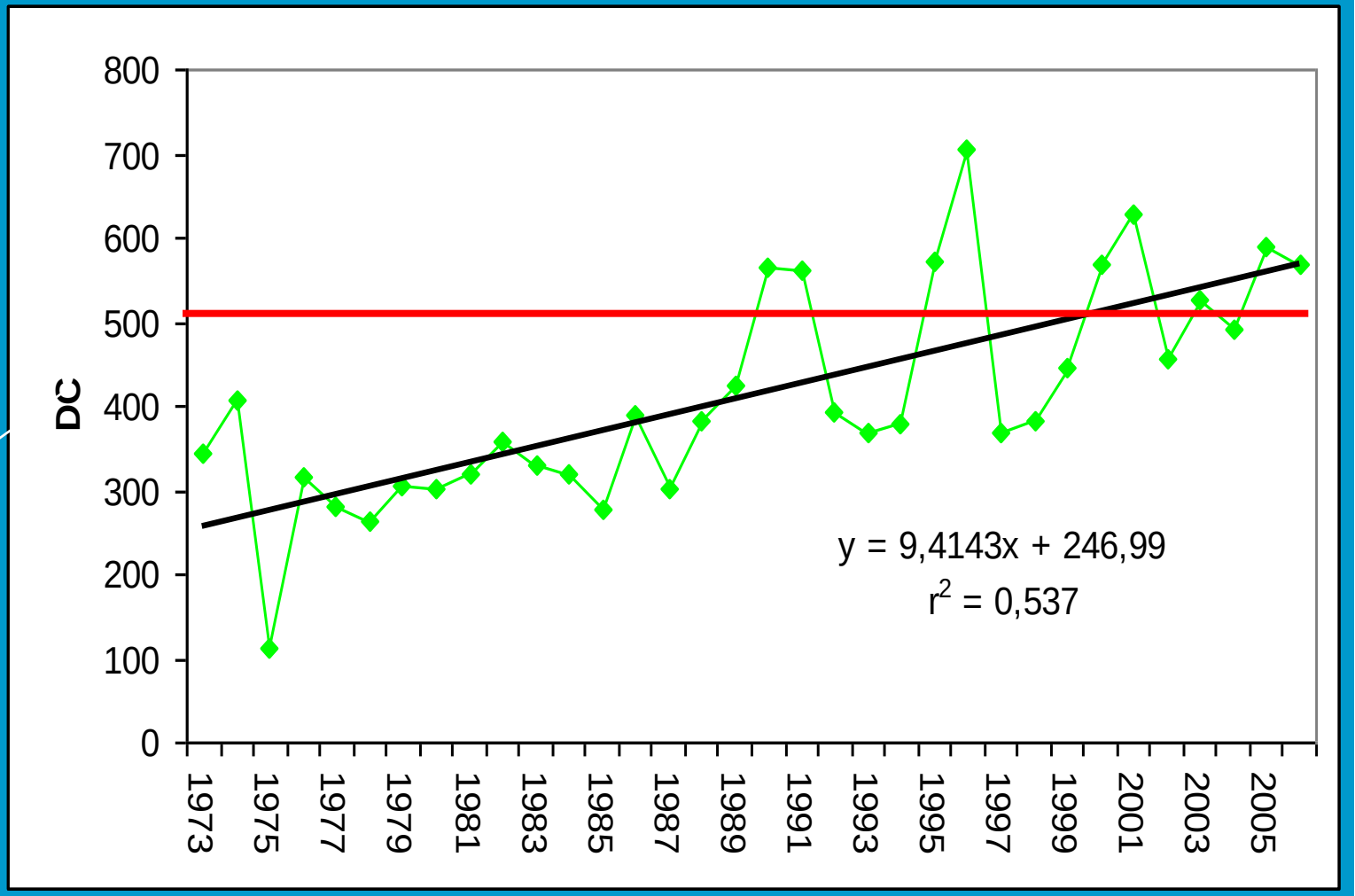
VIGO-SEPTEMBER

Dead fine fuel moisture estimator



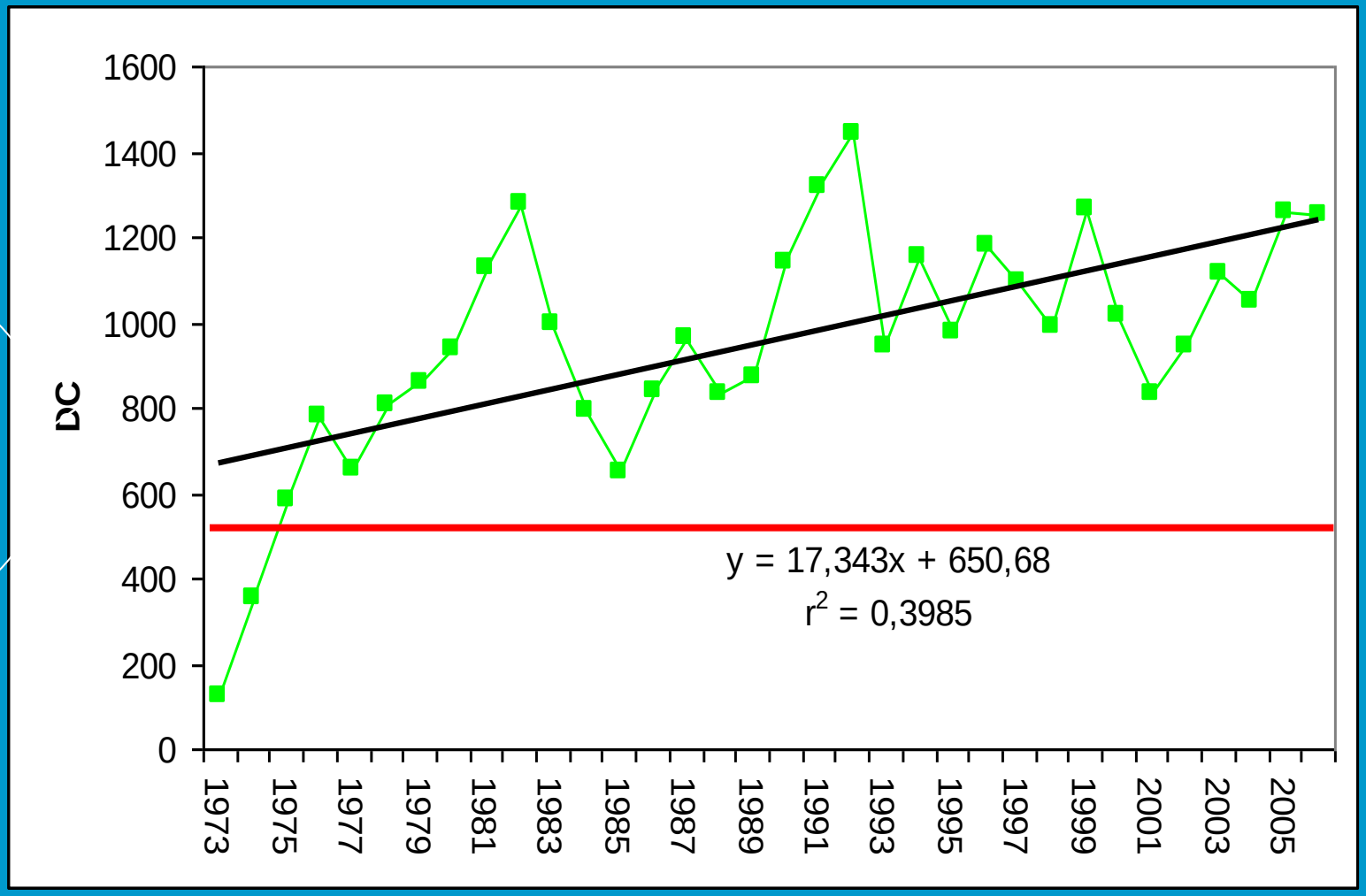
VIGO-JULY

Duff and soil surface moisture estimator



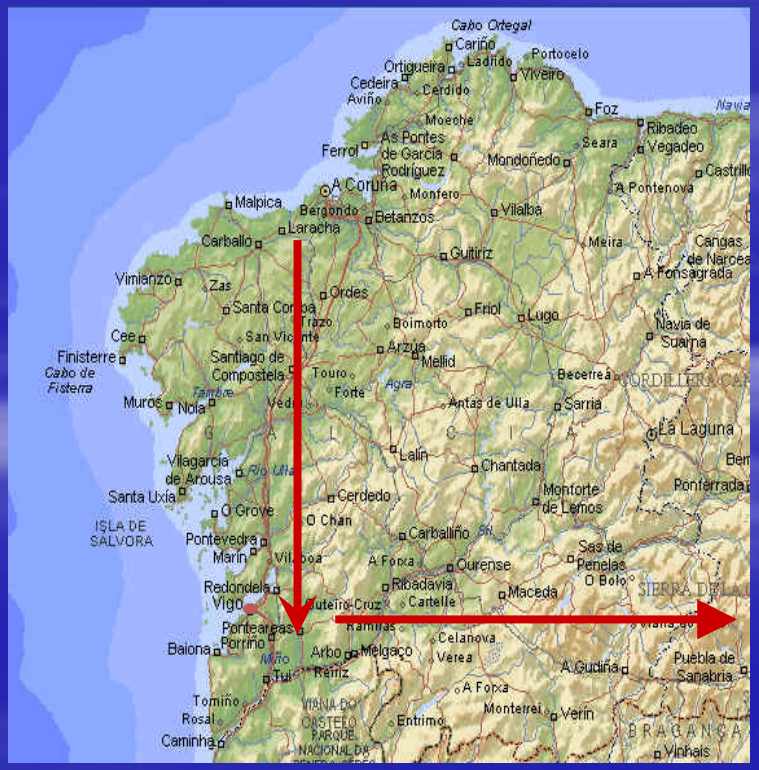
OURENSE-JULY

Duff and soil surface moisture estimator



HISTORICAL TRENDS

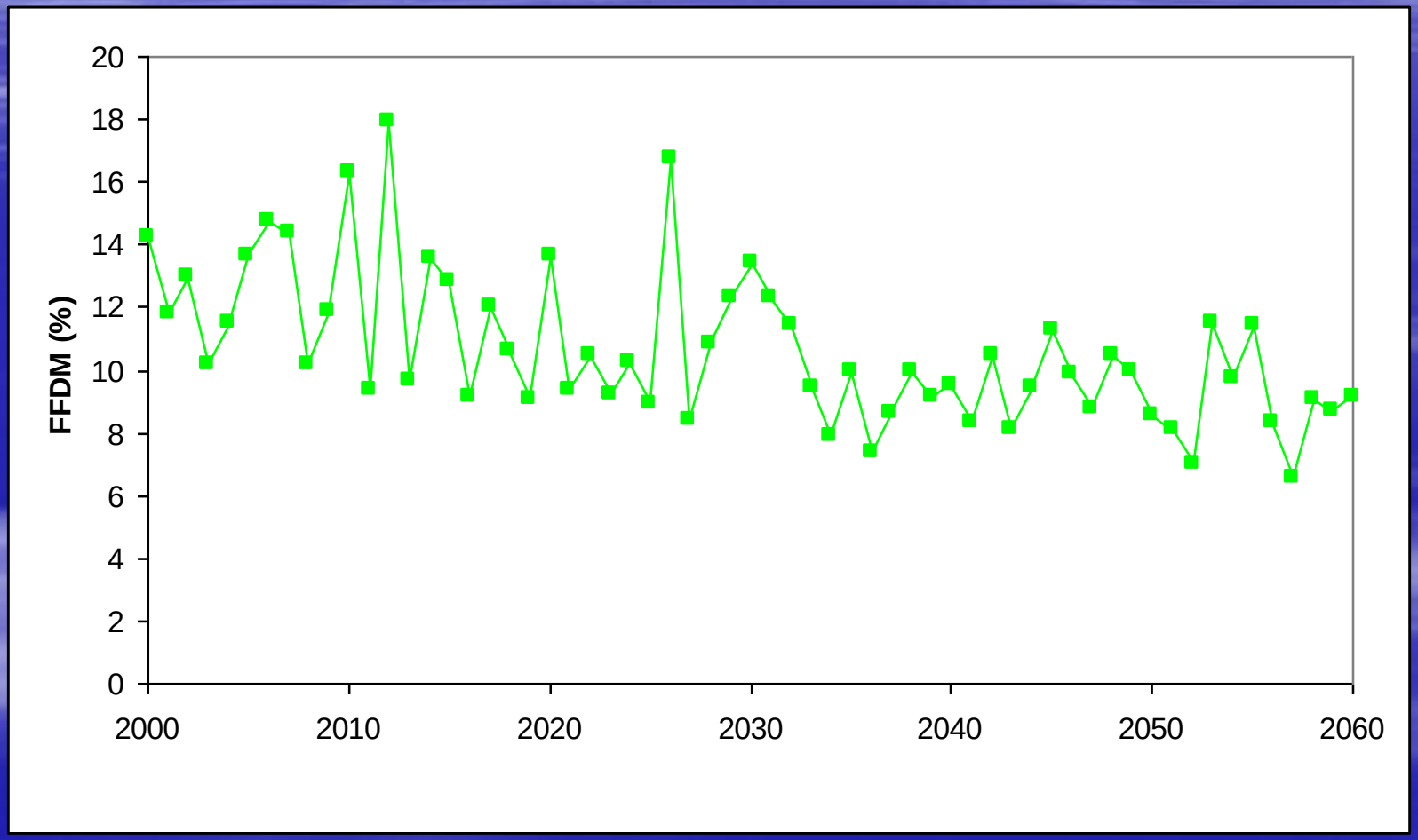
A trend to more favourable conditions for forest fires was detected in two main directions. From North to South, with worse conditions at lesser latitudes and from higher fire risk from West to East.



FUTURE TRENDS

A climate model HADCM3, with a scenario of emissions A1B was used to evaluate the impact of climate change on forest fire risk through the use of forest fire danger indices for the period 2000-2060.

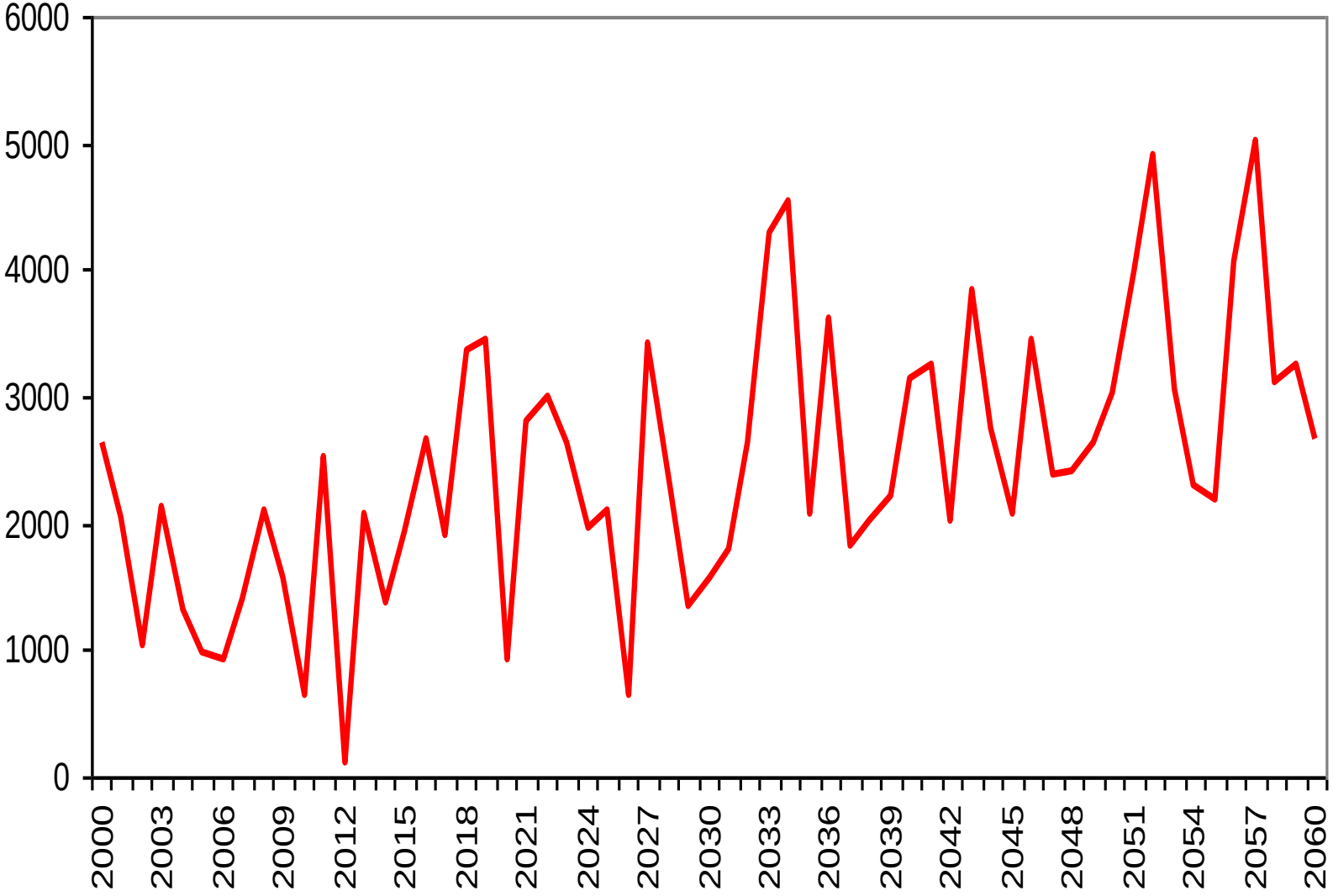
•Predicted dead fine fuels moisture content values were lower than those observed for the period 1973-2006.



PREDICTION OF NUMBER OF FOREST FIRES USING PLS REGRESSION

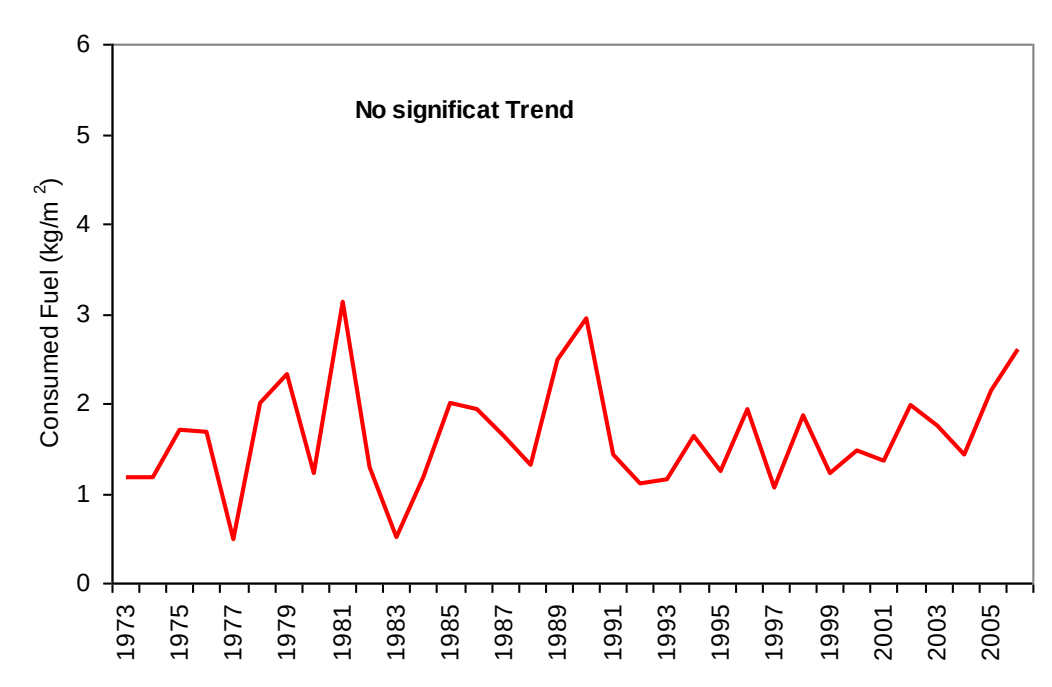
	Number of Forest Fires					
	MAR	JUN	JUL	AUG	SEP	Summer
Q^2 acum	0,661	0,584	0,455	0,681	0,639	0,489
R^2Y acum	0,742	0,619	0,516	0,702	0,666	0,557
R^2X acum	0,865	0,895	0,858	0,760	0,844	0,822
CBEFdes	-0,224					
CBEFadso						
CBEFadm						
GFDM						
FFDM						
FBO						
FFMC		0,178	0,129	0,154	0,142	0,138
DMC	0,241	0,225	0,157	0,171	0,185	0,143
DC				0,153		0,113
ISI			0,156	0,143	0,178	0,132
BUI	0,231	0,222	0,157	0,176	0,186	0,147
FWI	0,231	0,204	0,174	0,162	0,194	0,148

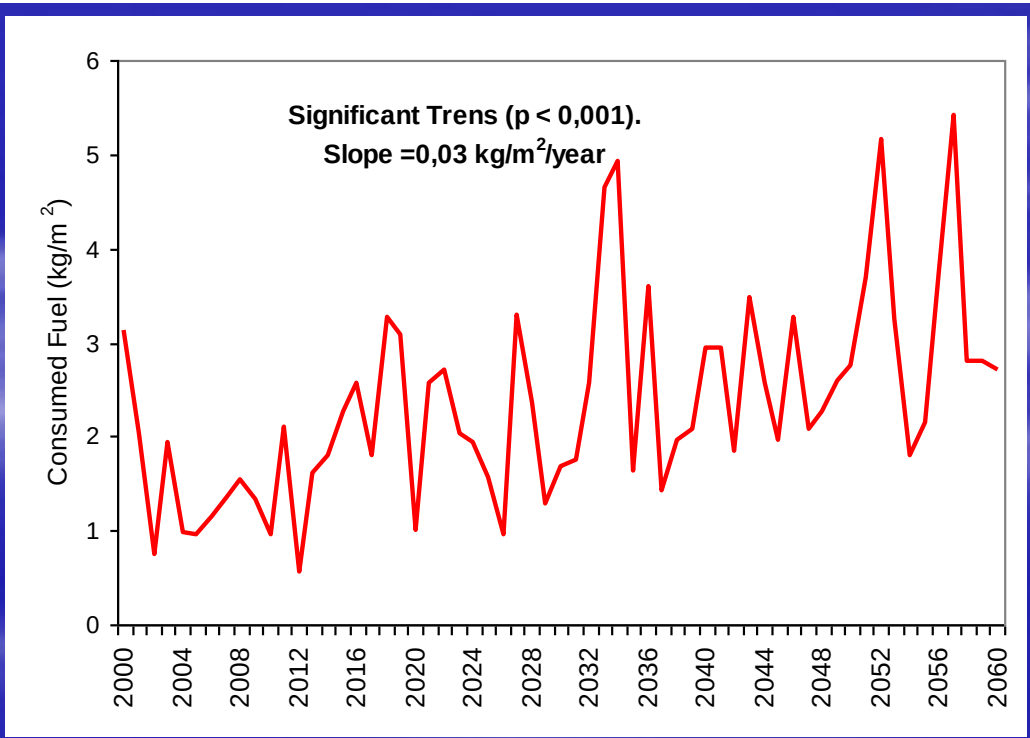
Predicted trend in the number of fires



- Most of the components of the Canadian Fire Danger Rating System changed from low risk to medium risk and from medium risk to high risk.

C6 Fuel Model

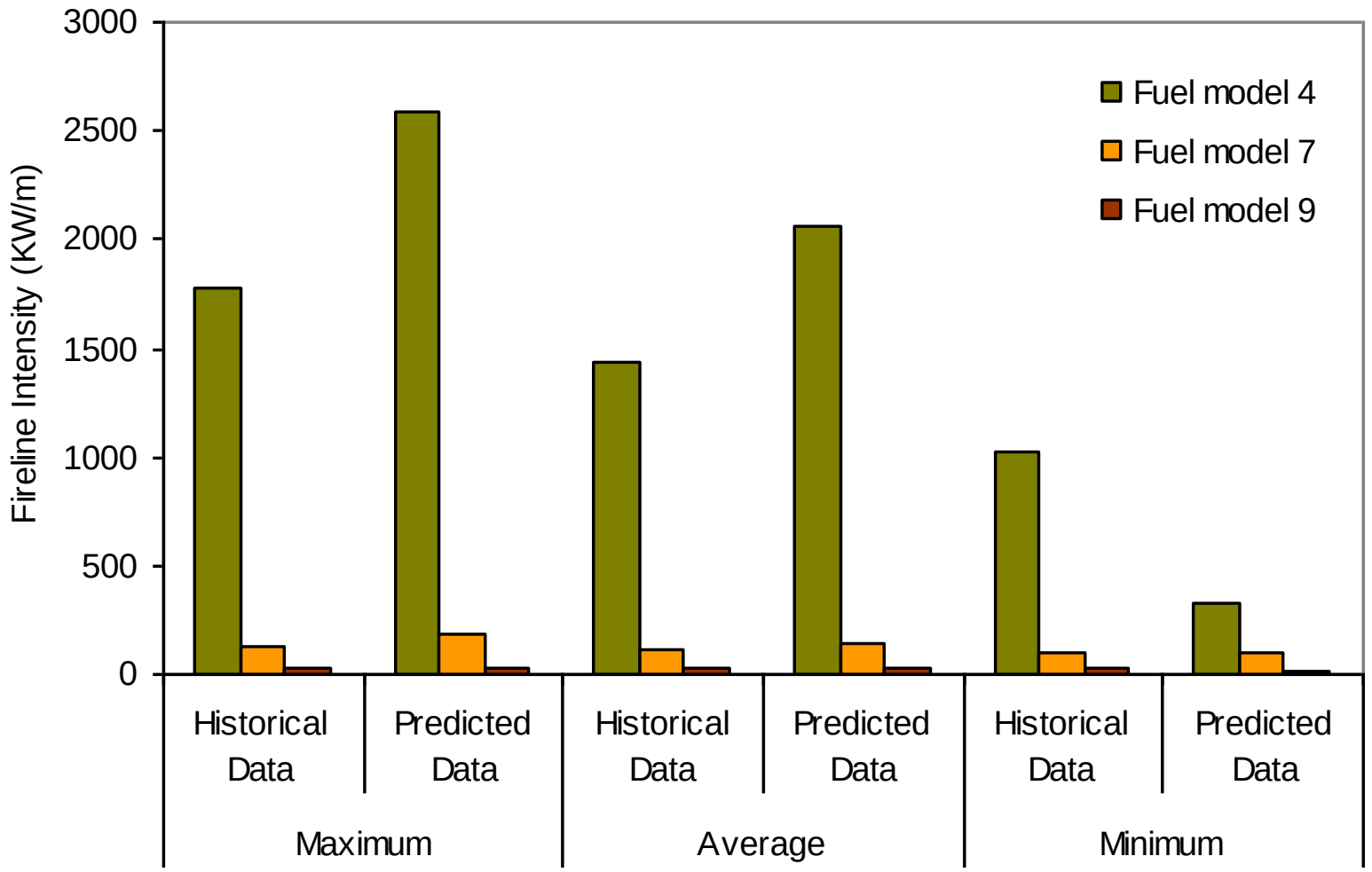




Behave Plus

Historical Data: 1973-2006

Predicted Data: 2000-2060



CONCLUSIONS

*Forest fire danger indices clearly showed a trend to worse conditions for fire initiation and propagation in Galicia in the last decades.

We can conclude that they are probably reflecting the consequences of global warming.

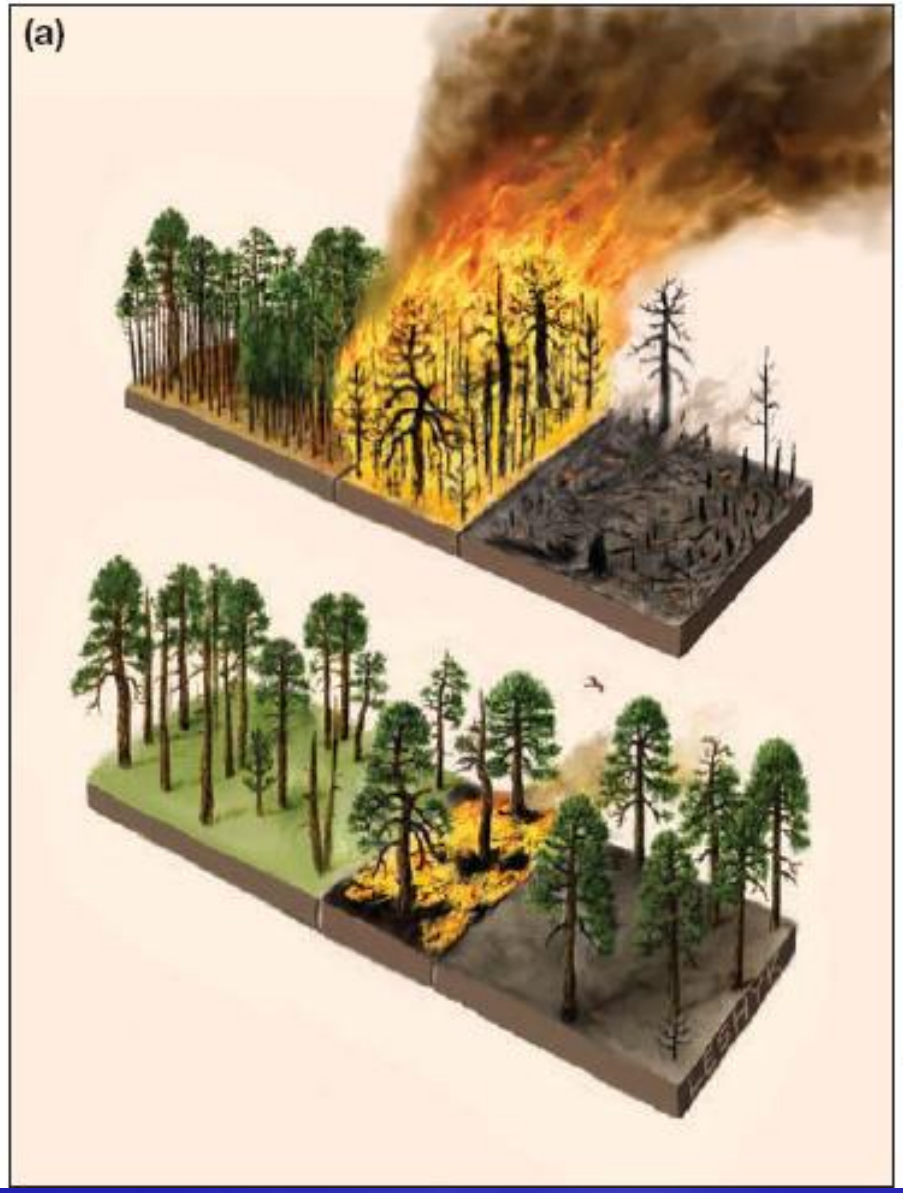
- The fuel moisture estimators were the group of forest fire danger indices that most clearly evidenced climate change trends.

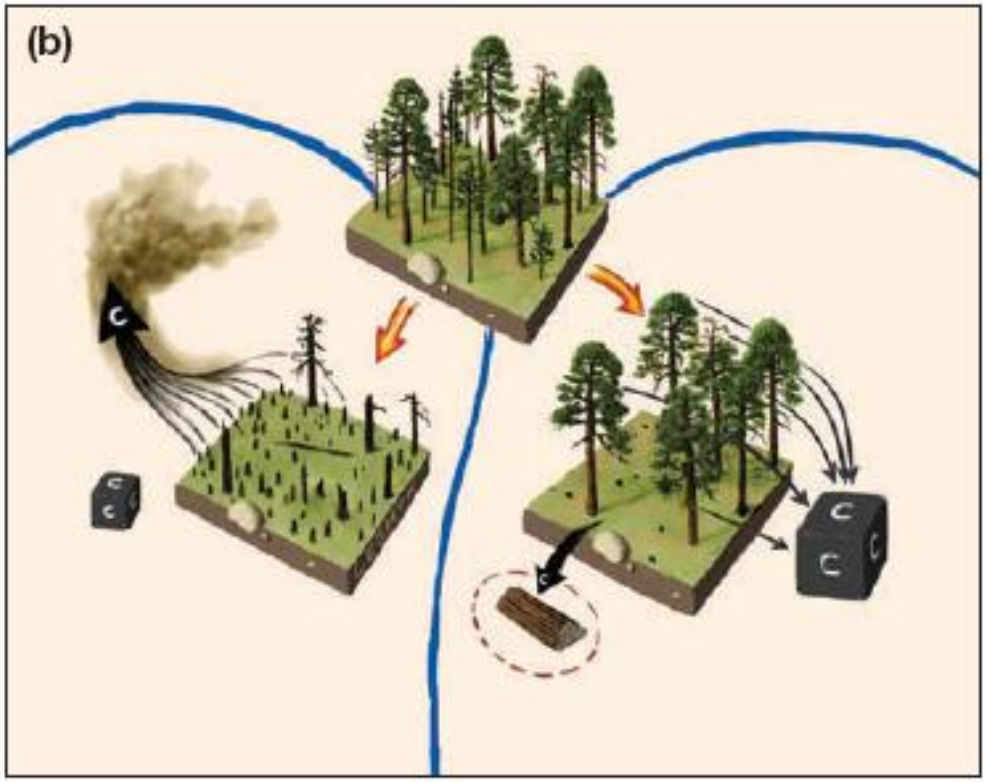
- Climatic simulation showed an increase of fire risk for the future decades in Galicia

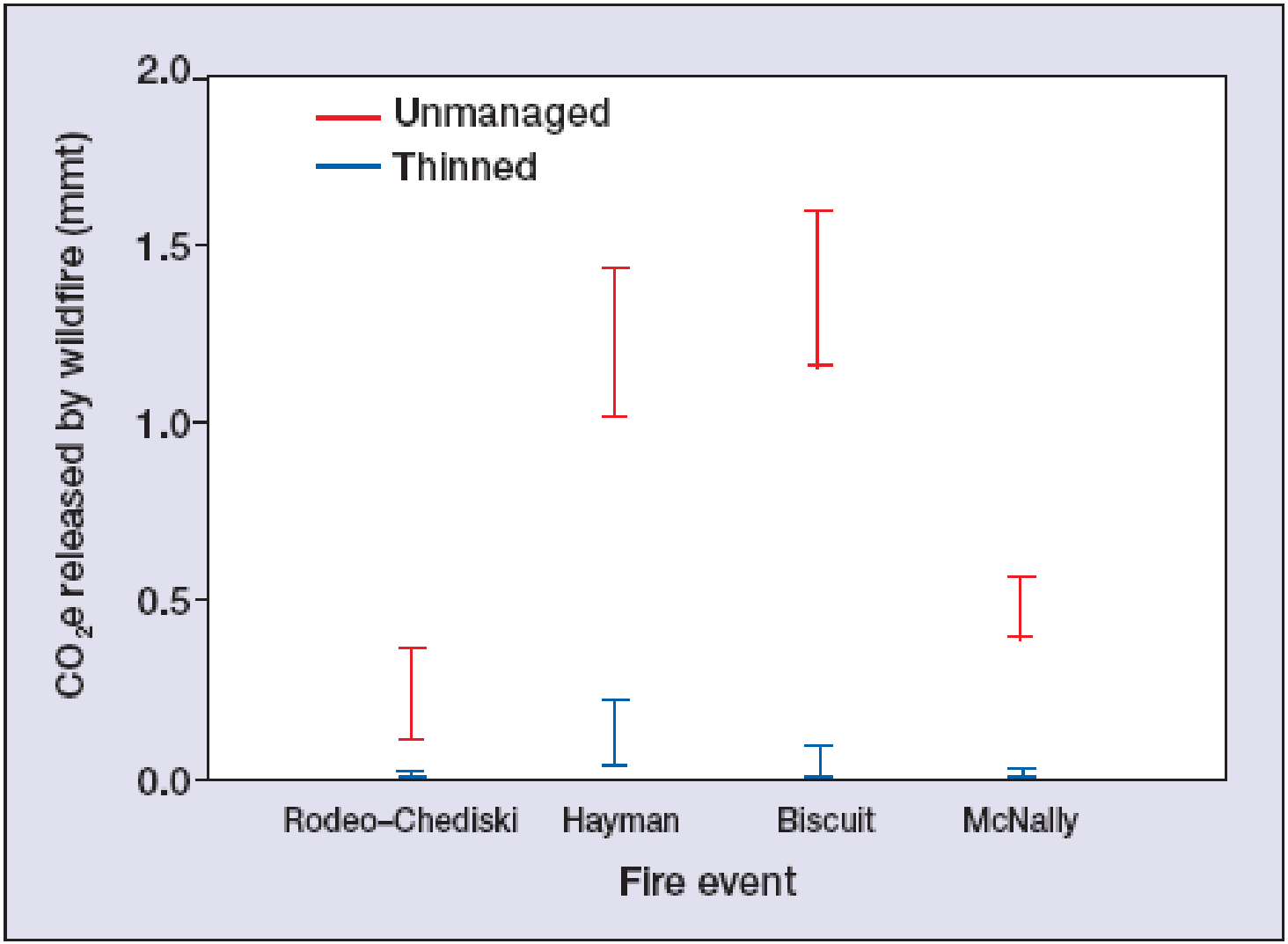
- The number of days with high fire risk is expected to substantially increase in the period 2000-2060.

Fire behaviour simulations in the future scenarios showed that the current investiment in forest fire protection is likely to have to increase in the future and…

Climaye change will demand a new selviculture (fuel management) to reduce the probability of high intensity fires.






Unmanaged
Thinned
2.0
1.5
1.0
0.5
0.0
CO_2e released by wildfire (mmt)
Rodeo–Chediski
Hayman
Biscuit
McNally
Fire event

THANKS!